

If we now consider the urticating cells we shall find that they may be compared both with the epithelial muscular cells and with the dermal gland-cells. Certainly in all cases, with the exception of *Physalia*, their glandular nature comes most prominently forward, for we have a plasma-derivative which is thrown off outwards, and consequently may be regarded as a secretion, while usually there is no contractile plasma-derivative; and we are not justified in speaking of muscles when we describe a structure which certainly contracts on irritation, but in which two kinds of substance are not recognizable, and in which therefore no profound division of labour has taken place in a contractile and a plasmatic part.

Independently of this, however, the double irritability of the cnidoblasts is in favour of the view that there may be "neuromuscular cells" which occur together with sense-organs and ganglion-cells, a view which has been opposed by Claus, the brothers Hertwig, and myself. But the cnidoblasts are such peculiar structures that we can scarcely draw any conclusion from them as to epithelial muscular cells, so that the neuromuscular theory can hardly be supported by them.

The glandular nature of the cnidoblasts becomes particularly probable if we accept the homology between adhesive granules and urticating capsules; and I would therefore regard *the cnidoblasts as unicellular dermal glands*.

XXXI.—*On a Case of Commensalism of a Caranx and a Crambessa.* By M. GODEFROY LUNEL\*.

THE case which has furnished me with the subject of the present memoir relates to animals belonging to very different classes, namely Fishes and Medusæ. Numerous memoirs, the enumeration of which would be out of place here, have been published by the older and more recent naturalists upon the organization and anatomy, or upon the development or the zoological characters of the animals of the latter class. I shall therefore confine myself to referring, at least in part, to what has been said upon their mode of alimentation.

The Medusæ feed upon small naked pelagic animals, and even, according to some authors, upon small fishes, which they

\* Translated by W. S. Dallas, F.L.S., from the 'Bibliothèque Universelle,' période 3, tome x., Archives des Sciences, p. 271, September 15, 1883.

seize and draw towards the mouth by means of their tentacles, their arms, and the urticating organs with which these are armed. This is what Spallanzani \* supposed, he having seen a small fish adhering to one of the appendages of a Medusa which he had just captured. Müller †, Otho Fabricius ‡, Diequemare §, and Bosc || state that they had seen Medusæ digest fishes. According to Péron and Lesueur ¶ the Medusæ make their regular prey of fishes from 12 to 15 centimetres long; and although their stomachs appear incapable of having any kind of action upon those animals, the latter were digested in a few moments. Gaede \*\* asserts that he found small fishes in the stomachs of Medusæ that he dissected. Eysenhardt and Chamisso †† have also stated that they several times met with the heads and remains of fishes, which had apparently been digested, in the stomachs of Medusæ. Professor de Blainville ‡‡ says that he had himself sometimes found small fishes in *Æquorea* and even in Rhizostomes; but he questions whether these small fishes had really been captured by the Acalephs, or whether they did not occur by accident where they were found. Cuvier was of the latter opinion, at any rate with regard to the Rhizostomes, having ascertained that those animals draw up their nourishment by a kind of suckers. Quoy and Gaimard §§, referring to the authors above cited, who declared that they had seen Medusæ digest fishes, think themselves able to assert that so complicated a phenomenon of digestion is perfectly impossible in the case of some species which are destitute of suitable organs for effecting it. In support of their assertion, and as furnishing an indisputable proof of it, these naturalists cite the capture made by them of a new species of *Dianæa* in the Mediterranean, near the coast of Valencia and the Balearic Islands. This Medusa, the structure of which did not differ at all from that of the other Radiaria of the same genus, presented no aperture which could enable it to allow the entrance of any substance of appreciable bulk. As to the figure given by Müller, and reproduced by other authors, of a Medusa swallowing a fish, Quoy and Gaimard say that it proves nothing, for, as Cuvier had pointed out, this fish could very easily have

\* Opuscoli di fisica animale e vegetabile, 1776.

† Zoologia Danica, 1776-89. ‡ Fauna Groenlandica, 1780.

§ Phil. Trans. and 'London Physical Journal.'

|| Histoire naturelle des Vers, 1802-15.

¶ Annales du Muséum, 1809, tome xiv. p. 325.

\*\* Beiträge zur Anatomie und Physiologie der Medusen, 1816.

†† Acta Acad. Leopold. Nat. Cur. 1821, vol. x. part 2.

‡‡ Dict. des Sci. Nat. 1823, tome xxix. pp. 389 *et seqq.*

§§ Voyage de l'Uranie, 1824, Zoologie, pp. 559 *et seqq.*

introduced itself through an aperture which is almost always gaping, and which offers but little resistance.

According to Lesson \* the prey of the Medusæ consists of small fishes &c., which they stupefy by a liquid which is caustic as regards this prey, but which often has no action upon man, although certain species are truly urticant when touched. The same author says that he had often seen the flesh of tolerably robust fishes absorbed by the parts of the Medusa which pressed against the scales, displacing them, and by their contact decomposing the fleshy matter into a sort of rosy sirupous liquid. Lastly this author adds that the wide inferior apertures to which Péron gave the name of *cavités stomacales*, while Lamarck, Cuvier, and De Blainville called them mouths, serve the Medusæ to swallow their prey.

In 1848, being on the beach of Maguelonne, near Montpellier, at the moment when the fishermen had brought in their net with several large Rhizostomes, I observed in the interior of one of these Medusæ a fish nearly as long as my finger, which still showed some signs of life and was in a perfect state of preservation. I could not, however, recognize the species, nor can I say in what cavity of the Medusa the fish was lodged. I may add that the fishermen greatly dread the corrosive action of the Medusæ upon their nets.

The Medusæ are not edible, and only serve as food to the Actiniæ, which seize them in passing by means of their tentacles. Whales are said to consume the small species in great quantities, engulfing them in their enormous mouths with other animals of different types which abound in the seas frequented by these great Cetaceans.

Fishes have sometimes been observed swimming around Medusæ and apparently pursuing them, which has led to the belief that these Vertebrata followed the Medusæ in order to feed upon them. Professor Cocco † was the first to make known a Mediterranean fish which, towards the end of the year 1834, appeared wheeling round a quantity of Medusæ, which in that year swarmed in the neighbourhood of Messina. The fact was inquired into soon afterwards by the same professor, who, from further observations, thought himself justified in giving this fish the specific name of *medusophagus*, or *eater of Medusæ*, on account of the avidity which it showed, according to him, in feeding upon the filiform tentacles of these Sea-Nettles, and the generic name of *Schedophilus*, which signifies *lover of the shade*. He adds that some Sicilian

\* Hist. Nat. des Zoophytes Acalèphes, 1843, p. 162.

† Giorn. Innom. Mess. ann. iii. no. 7, p. 50.

fishermen called it *Pisci d'Umbra*, while others named it *Pisci Purcu*, or pigfish.

Dr. Albert Günther\* has described and given a coloured figure of a *Schedophilus medusophagus* preserved in spirit, which he received, in May 1882, from his friend Mr. G. Douglas Ogilby with the following notes :—

“The fish was obtained during the second week of August 1878, in a salmon-net, at Portrush, co. Antrim, and came at once into my hands, none of the fishermen engaged in the fishery having previously met with any thing similar to it. It was the most delicate adult fish I ever handled—so much so that, within twenty-four hours of its capture, the skin of the belly with the intestines fell off when it was lifted, and it felt in the hand quite soft and boneless. Its stomach contained herring-fry. I may mention that a few days subsequently to the above date I got a fine specimen of a Tunny, also at Portrush.” Dr. Günther says that the fish obtained by Mr. Ogilby was a fine example of *Schedophilus medusophagus*, a genus which had not previously been met with near the British coast. He adds, “Originally described from specimens obtained in the Mediterranean, the species was afterwards found in the open Atlantic †, and quite recently in the South Sea ‡ near Samoa. It is evidently a pelagic form which, at least in the adult state, descends to some depth. The want of firmness in the tissues, well described by Mr. Ogilby, seems clearly to indicate it as a deep-sea fish. But we have no evidence as to the exact depth to which it may descend, which probably does not exceed a hundred fathoms.

“As in other deep-sea fishes, the young of this species are more frequently found near the surface than the adult, which are very rare. They accompany floating objects, chiefly for real or fancied protection, or for the sake of animalcules which congregate round every object floating on the surface of the sea; this is what induces these little fish to follow Medusæ. The idea expressed by the specific name of our fish, viz. that it follows Medusæ in order to feed on them, cannot be correct, as the fish could draw but little nourishment from those animals.” Lastly, according to Dr. Albert Günther, “The specimen obtained by Mr. Ogilby probably followed one of the shoals of fry of Clupeoids which annually travel from the open sea towards our coasts, and are followed by a number of southern fish which prey upon them and in their

\* Trans. Zool. Soc. Lond. vol. xi. p. 223, pl. xlvii.

† Günther, Catal. of Fish. ii. p. 412; Lütken, Vid. Selsk. Skr. 1880, p. 525.

‡ Günther, Fische d. Südsee, p. 149.

turn are pursued by larger pelagic fishes, such as Tunnies and other Scombroids."

Prof. H. Fol has given to the Museum of Geneva two individuals, one of them very young, of *Schedophilus medusophagus*, which he collected in the Bay of Messina at the time when he was devoting himself to the study of the lower animals of the Mediterranean. This naturalist has also seen these fishes swimming about Medusæ; but he has never observed that this was for the purpose of feeding upon them, nor did he see the Medusæ prey upon the fishes. Dr. Fol therefore does not believe that the Medusæ could eat fishes, however small: these Acalephæ, whose organization is so simple and so feeble, do not possess digestive organs powerful enough to digest a prey so firm. The Actiniae even, in which the tissues and the organs of digestion are better formed and developed than in the Medusaria, often only partially digest the small fishes and other little animals which they may capture, and reject the parts which are somewhat hard.

The following observations may furnish, at the same time, some interesting data as to the habits of certain species of fishes, and an explanation, perhaps more conclusive than that which has hitherto been given, of their manœuvres with respect to the Medusæ.

In a consignment of objects from the Mauritius sent to the Museum of Geneva by M. de Robillard, in May 1882, there were united and preserved in spirit a *Caranx melampygus*, C. & V.\*, and a *Crambessa palmipes*, Häck.†. The former of these animals was fixed by the greater part of its body in the apertures formed by the four columns which unite the stomach to the umbrella in the latter, and are traversed by canals serving to establish a communication between the stomachal cavity and the rest of the gastrovascular system‡.

All the hypotheses which tend to explain the association of fishes and Medusæ by assuming that one of these animals seeks the other as prey and for food are evidently inadmissible in the case now before us; for the Medusa belongs to the family Rhizostomeæ, and consequently has no buccal aperture properly so called, but only a series of microscopic pores which enable it to absorb food only in a state of extreme

\* Hist. Nat. des Poissons, 1833, tome ix. p. 116.

† System der Medusen, 1880, Bd. i. 2nd part, p. 620.

‡ I am indebted to the kindness of Dr. H. Fol for the determination of this Medusa, at least so far as he could make it with certainty, for the very indifferent state of preservation of the specimen did not enable him to count the lobules of the margin of the umbrella, which are no longer visible. I may add that Häckel described *Crambessa palmipes* from specimens coming from the northern coast of Australia.

division ; and, on the other hand, the fish only lodges itself in a natural cavity of the Medusa—a cavity which has nothing to do with the digestive or gastrovascular system. This cavity is widened by the prolonged use which the fish has made of it, and nevertheless the *Crambessa* is perfectly uninjured—an evident proof that the fish regards its associate as a place of refuge and not as a prey.

Surprised at the singularity of this fact, I wrote to M. de Robillard to ask him for some details upon the subject. The following is the reply that I received from him :—"The facts to which I called your attention with regard to the little fish which follows the anemone and constantly enters into it without quitting it is perfectly correct ; the fisherman who brought them to me captured them together. I can personally certify the fact. It is some years since, being on the quay of our port, I observed the same thing ; it was also the same species of fish as that which I sent to you which entered into the anemone and issued from it ; and as this took place at about 6 inches under water, it was very easy to observe what went on. The fish was alone, there were no others. What explanation is to be given of this phenomenon ? Is it that the fish finds something to eat in the anemone which induces it to pursue and penetrate into it ? I cannot say : the anemone, although receiving the fish, is alive, and one sees it move. You should verify the interior of the anemone to see that nothing has been destroyed by the fish."

Lastly, having requested M. de Robillard to endeavour to procure for me, if possible, some specimens of the two animals in question, I received from him, while I was engaged in preparing these notes, a letter, dated July 15, 1883, announcing a fresh consignment of objects for the Museum, and further a tin box containing two Medusæ, each with its little fish ; he had received them in sea-water, the fishes and Medusæ all living. I do not know how it came about that, unfortunately, all the objects announced were in the case except the box with the Medusæ ; I suppose that M. de Robillard forgot to put them in.

Leaving on one side, then, all the hypotheses hitherto put forward about Medusæ eating small fishes and small fishes eating Medusæ, I arrive at the following conclusion, corroborated by the fact which I have pointed out, namely, that there are certain species of fish of which the adults live at more or less considerable depths, and of which the young, compelled either by some undetermined peculiarity of their organization or by the necessity of seeking food better suited to their age, come up to seek certain Medusæ at the surface of the sea. It

is there that the small pelagic animals upon which they feed swarm, as also do the Medusæ. Then comes to pass this very strange fact, which, however, is none the less proved, namely, that the fish, entering into certain natural anfractuositics of the Medusa, lodges there, issues thence, returns there at pleasure, and thus becomes its commensal. This is the only way, I believe, to explain this kind of association between two animals of such different types. It is to be remarked that, in order to penetrate into the Medusa without lacerating its tissues, the fish is compelled to swim on one side, that is to say in a perfectly abnormal position.

I take advantage of this opportunity to make known a new case of parasitism. I refer to the discovery of two examples of *Dorychthys excisus* (Kaup), male and female, found living in a Holothuria. These two fishes were sent to me from the Mauritius in October 1881 by M. de Robillard, with the assurance that they were quite alive when he took them out of the Holothuria. Unfortunately he could not tell me the species to which the Echinoderm belonged. Under any circumstances the fact seemed to me the more interesting and the more deserving of being noted, as it is, I believe, the only case of parasitism hitherto observed in the case of a fish of the order Lophobranchii.

The following are some characters of this *Dorychthys* which may serve to identify the species or to determine the age:—Total length 50 millim. Plates 18 + 15—16.

#### BIBLIOGRAPHICAL NOTICES.

*Minute Structure of the Central Nervous System of certain Reptiles and Batrachians of America.* Illustrated by permanent photomicrographs by JOHN J. MASON, M.D. Series A. Author's Edition. One hundred. Newport, 1879–1882.

THE methods of histology have reached a perfection which is building up new departments of knowledge; and among successful pioneers in these labours Dr. Mason will always hold an honoured place for the technical skill with which he brings the reader face to face with the revelations of his microscope, and for the sumptuousness with which his work is given to the world. No such monograph has previously come under our notice, for the illustrations of a difficult research leave nothing to be desired. Some nineteen reptiles and batrachians have been studied; and the author has turned his attention to the structure of the spinal cord, the medulla